



2010

# Using and Improving EARS for Local Public Health Biosurveillance

Fricker, R.D.

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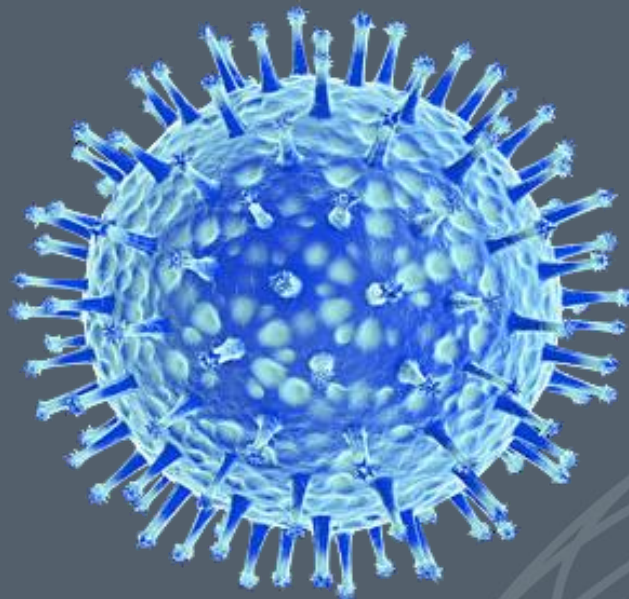
Invited speaker, Using and Improving EARS for Local Public Health Biosurveillance  
Suzie Barnes, California Conference of Local Data Health Managers, August 2010.



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# Using and Improving EARS for Local Public Health Biosurveillance

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and

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Naval Postgraduate School

August 23, 2010



# Outline of Presentation

- Define biosurveillance
- Discuss evolving need for syndromic surveillance at Health Department
- Describe the EARS program and its use within Monterey County
- Quantitative and qualitative analysis of modifications to EARS' logic



# What is Biosurveillance?

- Homeland Security Presidential Directive HSPD-21 (October 18, 2007):
  - “The term ‘biosurveillance’ means the process of active data-gathering ... of biosphere data ... in order to achieve early warning of health threats, early detection of health events, and overall situational awareness of disease activity.” <sup>[1]</sup>
- Syndromic surveillance:
  - “...surveillance using health-related data that precede diagnosis and signal a sufficient probability of a case or an outbreak to warrant further public health response.” <sup>[2]</sup>

[1] [www.whitehouse.gov/news/releases/2007/10/20071018-10.html](http://www.whitehouse.gov/news/releases/2007/10/20071018-10.html)

[2] CDC ([www.cdc.gov/eпо/dphsi/syndromic.htm](http://www.cdc.gov/eпо/dphsi/syndromic.htm), accessed 5/29/07)



# Need for Syndromic Surveillance

- County Health Officer wanted greater use of real-time surveillance data
- Preparedness grants required enhanced surveillance
- Lag-time in receipt of reports from local hospitals; reports from only two hospitals



## Early Aberration Reporting System (EARS)

- Developed by the CDC
- Originally designed to monitor for bioterrorism during large-scale events that often have little or no baseline data
- Now used by various state and local public health departments for routine health surveillance purposes





# Benefits of the EARS Program

- Data stays at the local level
- Flexibility to modify syndromes as needed
- Analysis occurs on-site
- Decreased lag-time in reporting
- Program available at no cost



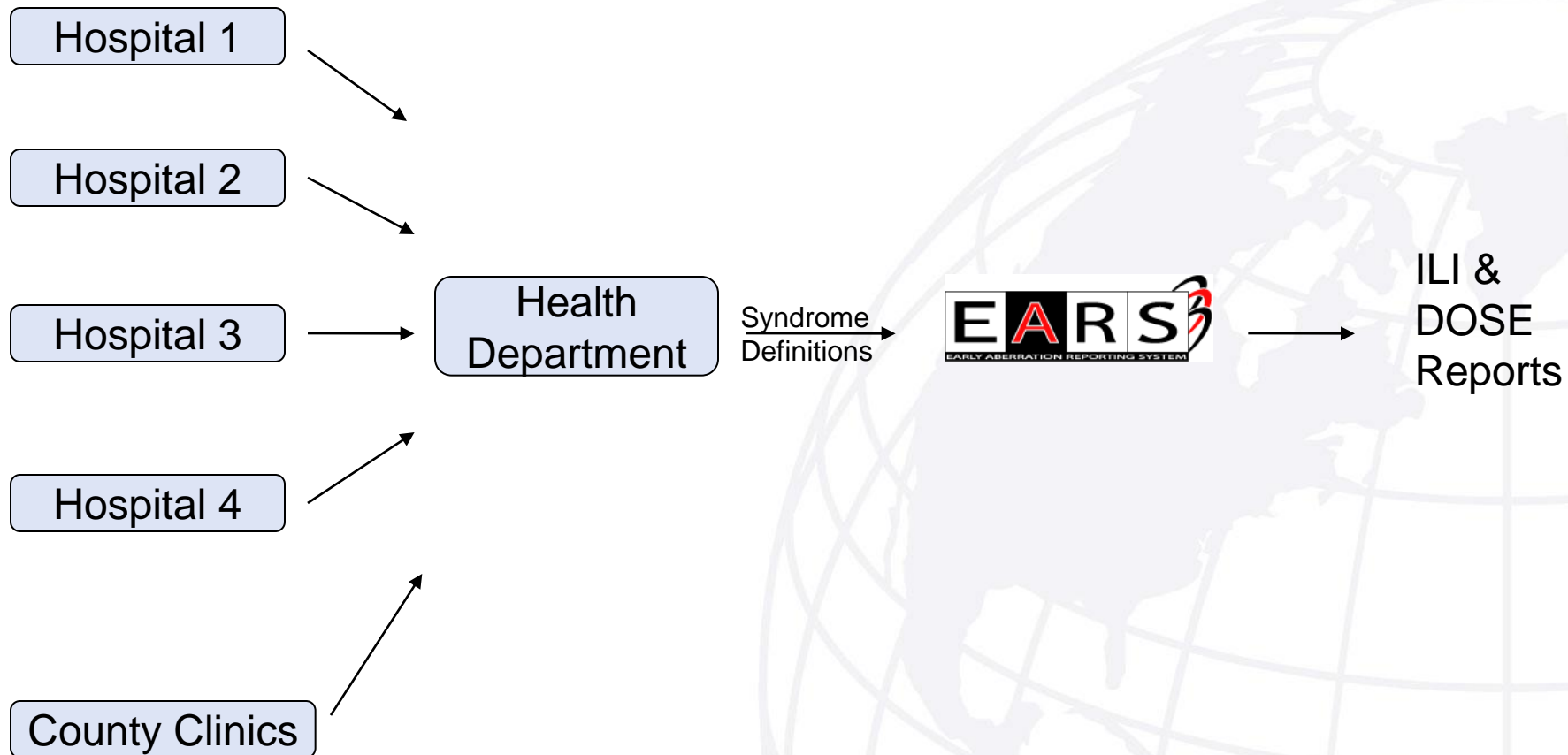
# Data Collection and Reporting

## Data Collection

## Data Management

## Analysis

## Reporting







# Daily Observational and Situational Evaluation (DOSE) Report

## ED Census and Clinic Services Census\*:

Green	No alert flags on the previous day
Yellow	One alert flag on the previous day
Orange	Two alert flags on the previous day
Red	Three alert flags on the previous day <b>or</b> three consecutive days of single <b>or</b> double alert flags

Total Hospital Census 319

Clinic Services Visits 719

**\*\*Note that the hospital ED aggregate and syndromic surveillance only includes data from facilities providing information for the reported days.**

## Syndromic Surveillance\*: (EARS output for Monterey County aggregate w/o clinics) [Shown as # of patients]

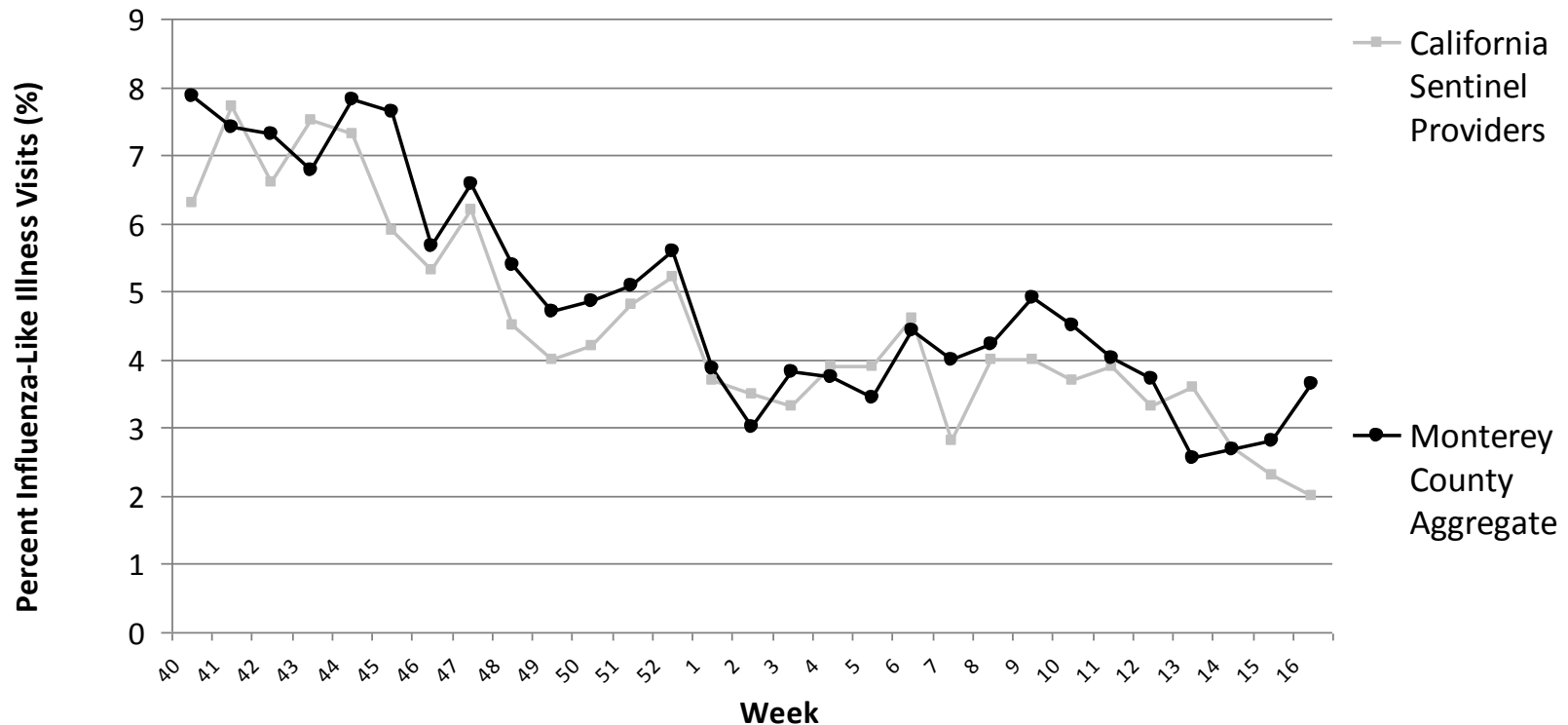
Green	No alert flags on the previous day
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Gastrointestinal	58
Influenza-Like Illness	6
Lower Respiratory	9
Upper Respiratory	29
Neurological	30



# ER ILI Visits for Monterey County and California, 2009-2010 Season To Date

Emergency Room Influenza-Like Illness Visits for Monterey County and California, 2009-2010 Season To Date



Note: Restricted ILI syndrome definition



# Early Aberration Reporting System

- Designed by the CDC to be a drop-in surveillance system
- Increasingly being used as standard health surveillance system
  - E.g., by the Monterey County Health Department





# Assessing Modifications to EARS

- Flexibility of EARS is a strength
- However, what happens when the syndrome definitions are changed?
  - I.e., how do the changes affect detection performance (sensitivity and specificity)?

		Test Outcome		
		Positive	Negative	
Actual Status	Sick	<b>TP</b>	<b>FN</b> (Type II error)	Sensitivity = $\frac{\#TP}{\#TP + \#FN}$
	Healthy	<b>FP</b> (Type I error)	<b>TN</b>	
				Specificity = $\frac{\#TN}{\#TN + \#FP}$



# Creating Syndromes

- Syndromes derived by searching for key words in chief complaints
- Three important parts to the process:
  - Defining symptom aliases
    - Lists of words, abbreviations, and medical jargon that are mapped to a specific symptom
  - Text matching algorithms
    - Computer logic that specifies when a match has occurred
  - Syndrome definitions
    - Syndromes can be derived from the symptoms in a variety of ways



# ILI Symptom Aliases

Symptom Alias	Symptom	Symptom Alias	Symptom	Symptom Alias	Symptom
SROETHROAT	SORETHROAT	COL	COLD	COUGH	COUGH
SSORE THROAT	SORETHROAT	NOSE	COLD	C9UGH	COUGH
ST	SORETHROAT	URI	COLD	CCOUGH	COUGH
TBROAT	SORETHROAT	EAR PAIN	COLD	CIUGH	COUGH
THROAT	SORETHROAT	DISCH	COLD	CKUGH	COUGH
TH4OAT	SORETHROAT	OM	COLD	OUGH	COUGH

## Actual Chief Complaint Examples:

- 1) NP FOR HIV TEST PER VERONICA/CHART MADE/LM





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## Chief Complaint Examples:

- 1) NP FOR HIV TEST PER VERONICA/CHART MADE/LM
- 2) RTN RE-COLPO/LM



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## Chief Complaint Examples:

- 1) NP FOR HIV TEST PER VERONICA/CHART MADE/LM
- 2) RTN RE-COLPO/LM
- 3) R/S PREV APPT CALL NOT GOING THROUGH



# Text Matching Logic Example: ILI

- **EARS (CDC) Logic**

If an ILI symptom alias is found anywhere within the chief complaint text, then it will be flagged as an ILI indicator

- **Enhanced (NPS) Logic**

- For short words ( $\leq 3$  characters)
  - No variations on alias words allowed
  - Example: ■ ST ■
    - NP FOR HIV TESTST PER VERONICA/CHART MADE/LM
  - Example: ■ COL ■
    - RTN RE-COLPO/LM
- For longer words ( $\geq 4$  characters)
  - Variations on one side of the alias word is allowed
  - Example: ■ COUGH ■
    - PT COUGHING FOR 4 DAYS
  - Example: ■ OUGH ■
    - R/S PREV APPT CALL NOT GOING THRUOUGH



# ILI Syndrome Definitions

- Standard EARS (CDC) def'n:
  - “sore throat” **or**
  - “cold” **or**
  - “cough”
- Expanded (MCHD) def'n:
  - “cold” **or**
  - “cough” **or**
  - “fever” **or**
  - “chills” **or**
  - “muscle pain” **or**
  - “headache” **or**
  - “flu” **and not** “shot”
- Restricted (MCHD) def'n:
  - “fever” **and** “cough” **or**
  - “fever” **and** “sore throat” **or**
  - “fever” **and** “cough” **and** “sore throat” **or**
  - “flu” **and not** “shot”



# Qualitative Comparisons

## Aug 1, 2008 – July 31, 2009

### Base Case

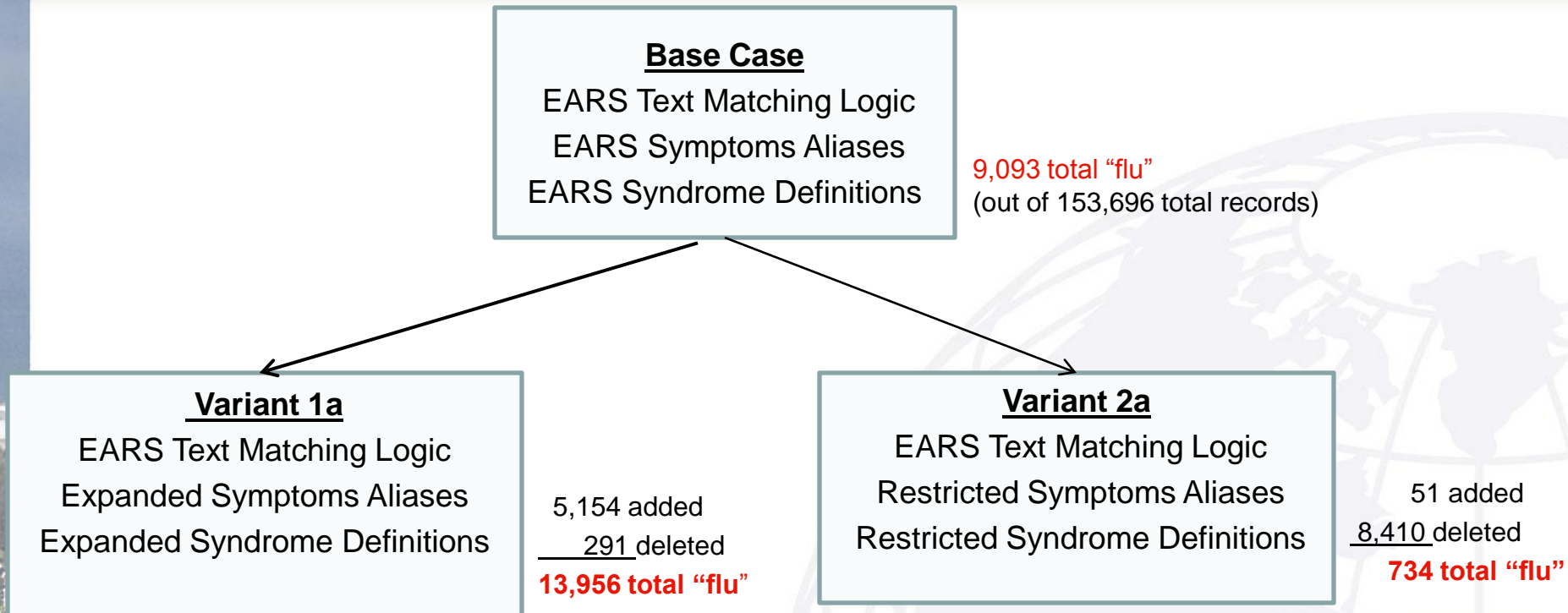
EARS Text Matching Logic  
EARS Symptoms Aliases  
EARS Syndrome Definitions

9,093 total “flu”  
(out of 153,696 total records)



# Qualitative Comparisons

## Aug 1, 2008 – July 31, 2009

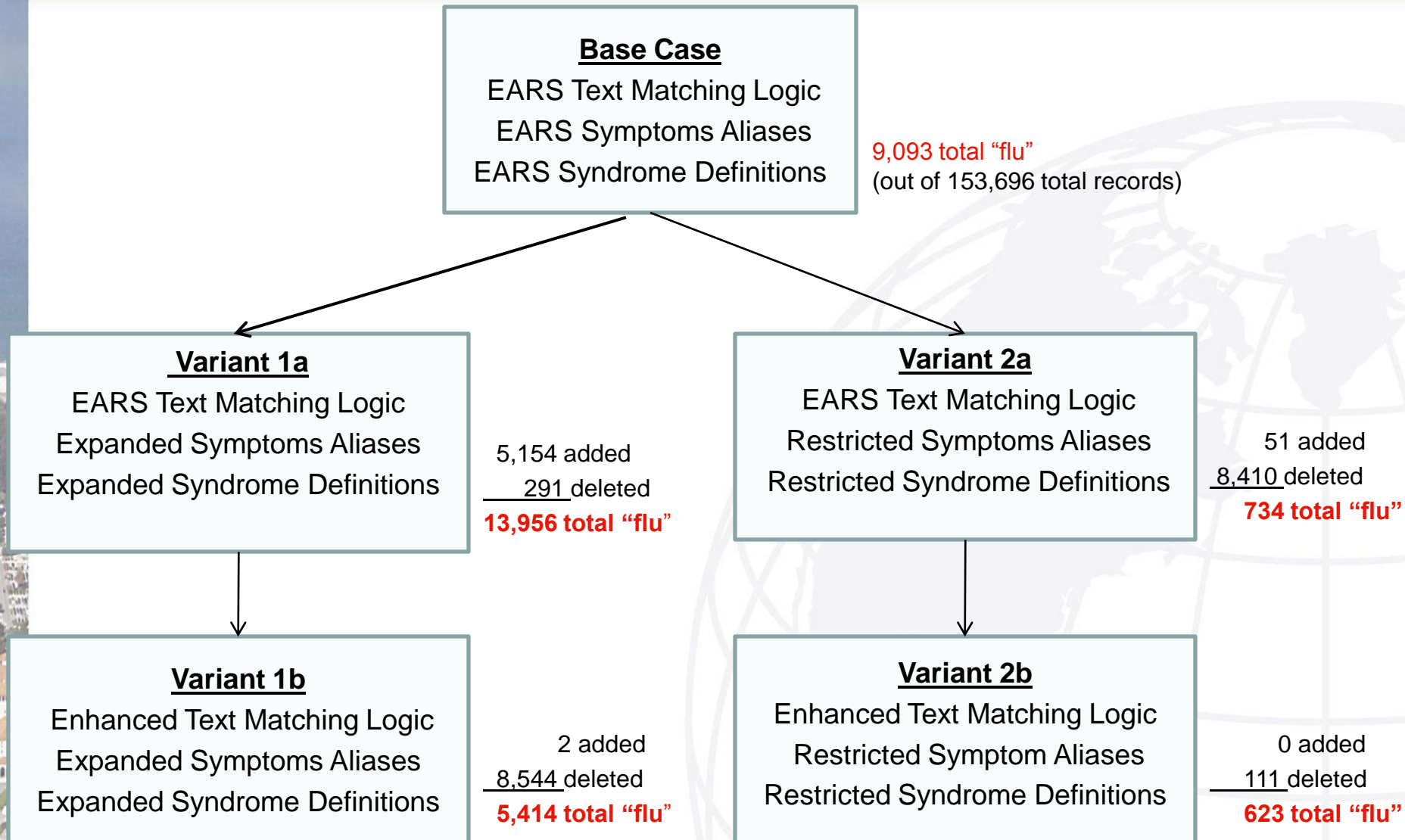






# Qualitative Comparisons

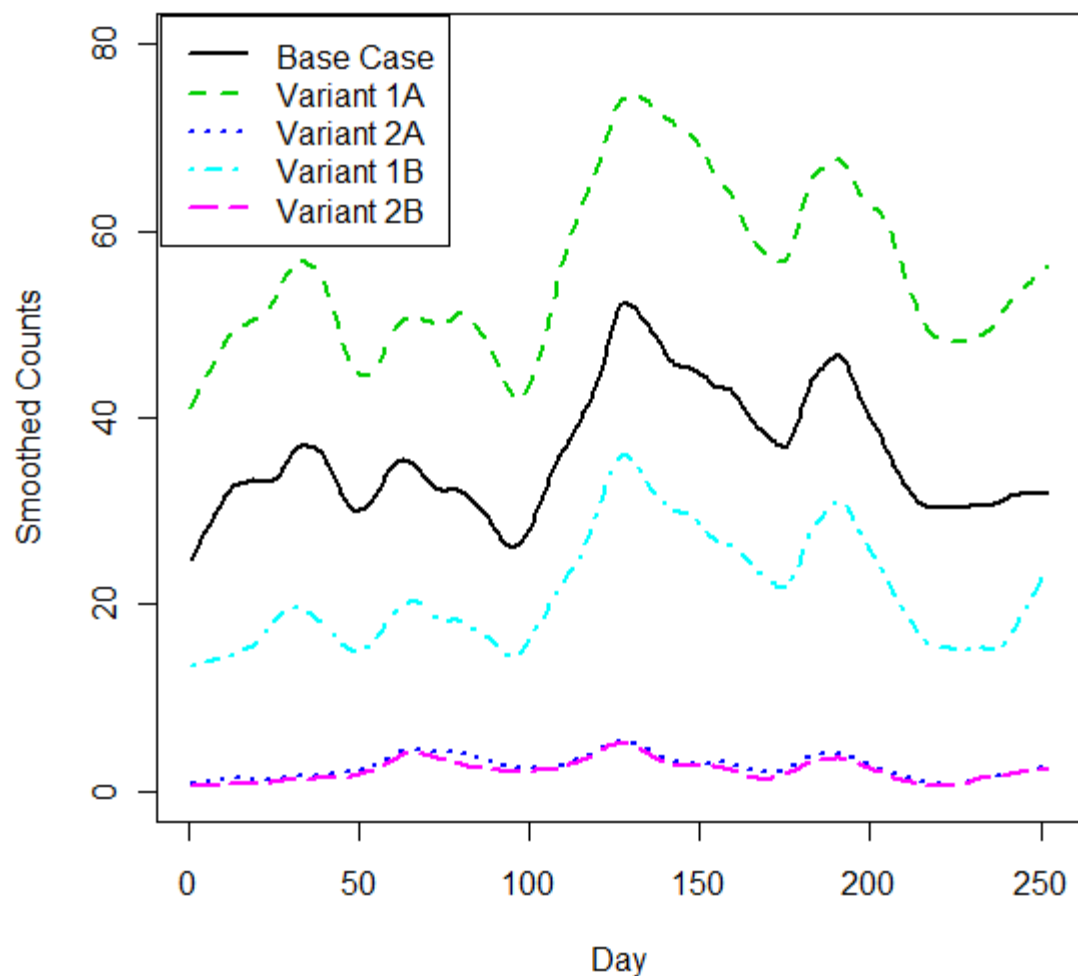
## Aug 1, 2008 – July 31, 2009





# Qualitative Comparisons Aug 1, 2008 – July 31, 2009

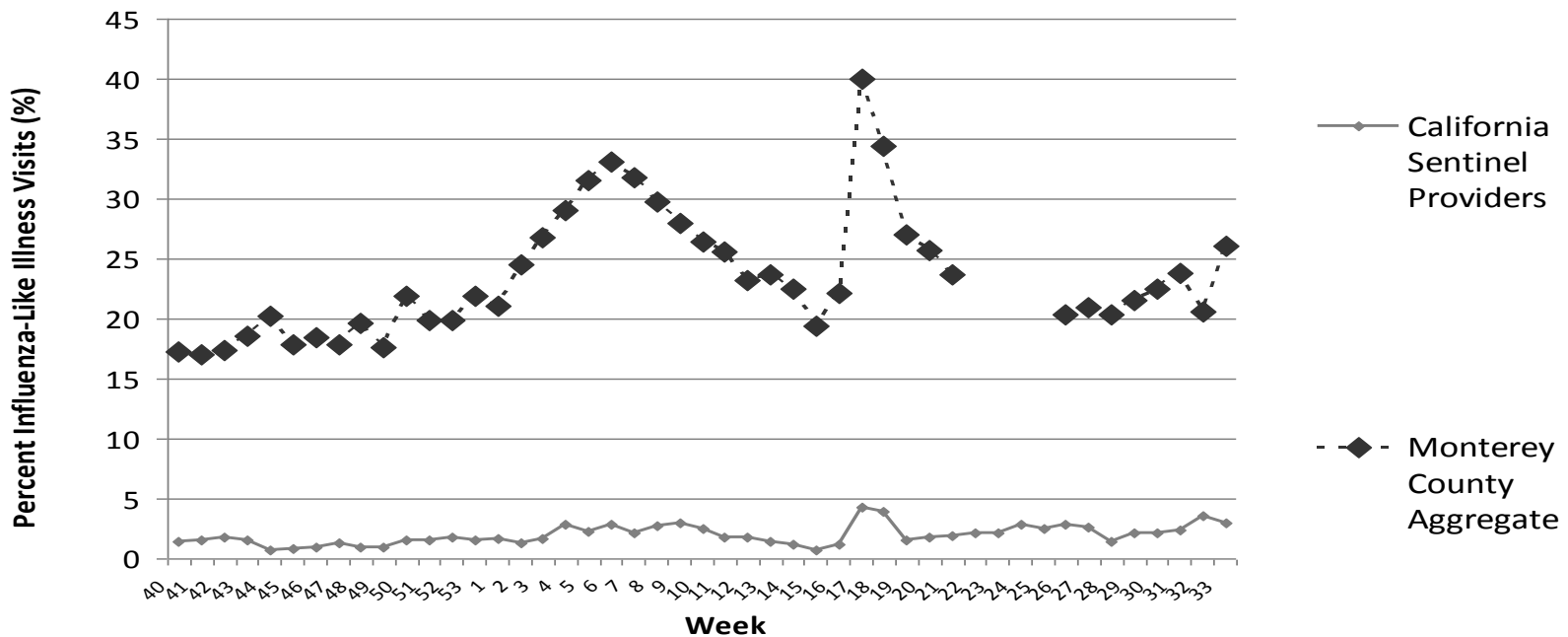
ILI Syndrome





# Expanded ILI Syndrome Counts vs. California Sentinel Providers

**Emergency Room Influenza-Like Illness Visits for Monterey County and California, 2008-2009 Season**



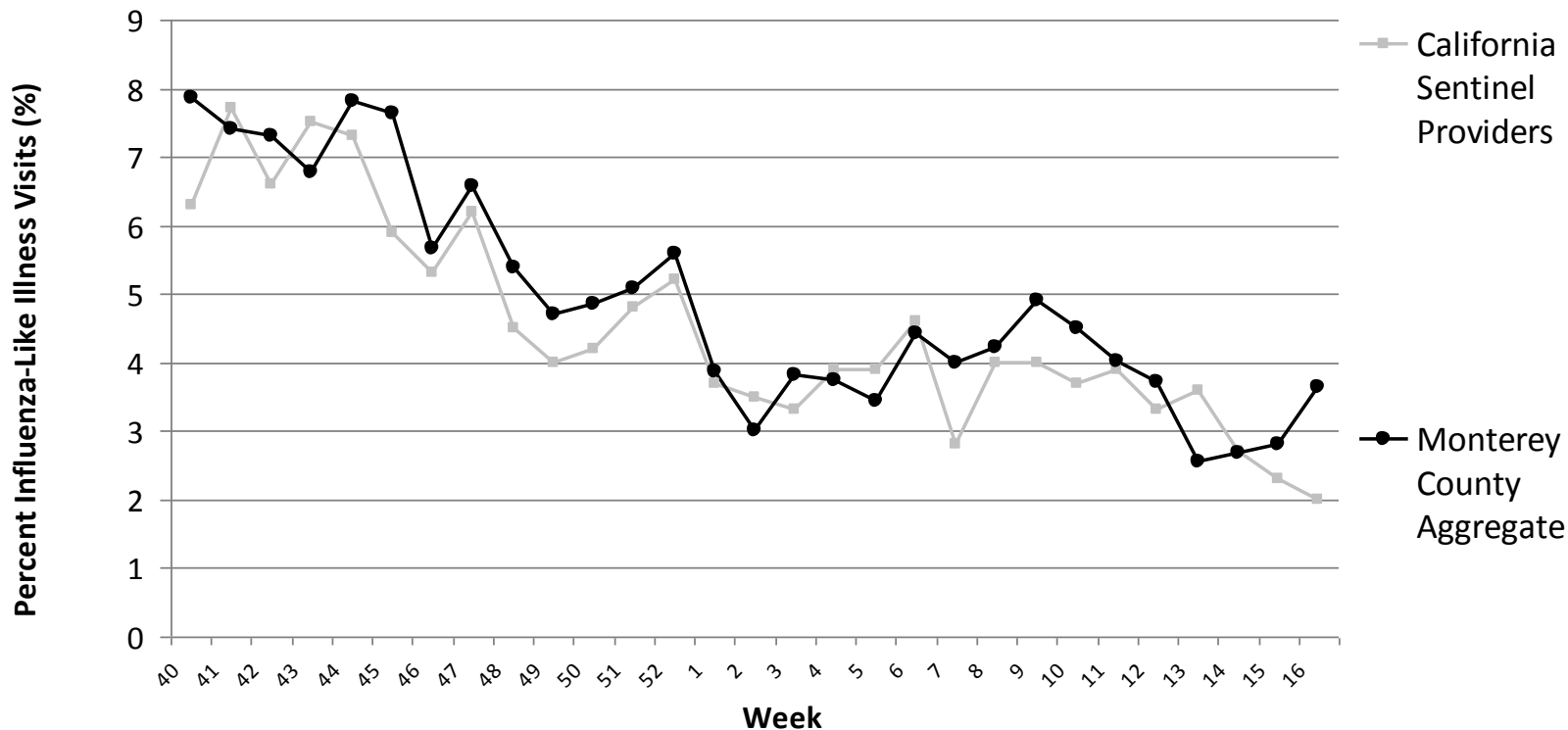
Note: 1. Graph based on ILI chief complaint data as proportion of all patients accessing services for a given week from California sentinel providers and an aggregate from Monterey County Hospitals CHOMP, SVMH, and Mee, and Monterey County Clinical Services. 2. Missing data points for Weeks 19 through 27 will be incorporated at a later date.

Source: MCHD Influenza-like Illness (ILI) Surveillance Report Week 33 Ending 8/22/09



# Restricted ILI Syndrome Counts vs. California Sentinel Providers

Emergency Room Influenza-Like Illness Visits for Monterey County and California, 2009-2010 Season To Date



Note: Restricted ILI syndrome definition



# Assessing the Effects of Changes

- How to figure out which combination of methods works best?
- Attempted to compare to ICD-9 codes, but codes for Monterey clinic data not sufficiently precise
- Currently evaluating EARS performance in detecting 2009 H1N1 outbreak using the various definitions and logic
  - Comparing signals to known cases

- Small changes in syndrome definitions, symptom aliases, and text-matching logic can have large effects on the resulting syndrome counts and overall “trend”
- Recommend on-going research that conducts comparisons between methods under various conditions
  - Must assess how changes affect sensitivity and specificity
- Exercise caution!!







Questions?



# Contact Information

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